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EXAMINER	
HU, HENRY S	

ART UNIT	PAPER NUMBER
1796	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/519,321	OREN ET AL.	
	Examiner	Art Unit	
	HENRY S. HU	1796	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *Election of February 19, 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-38* is/are pending in the application.

4a) Of the above claim(s) *32-36* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-31,37 and 38* is/are rejected.

7)☒ Claim(s) *1* is/are objected to.

8)☒ Claim(s) *1-38* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09 May 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This Office Action is in response to **Election** along with its **Pre-Amendment** both filed on February 19, 2009, which is response to Restriction requirement filed on February 3, 2009. With such pre-amendment, **new Claim 38 is added (now is joined with elected Group I), while no claim was cancelled or amended**.

Applicant's Election of Group I, Claims 1-31 and 37-38 is traversed with remarks on page 1. It would thereby not place an undue burden to search and examine the non-elected Group II (Claims 32 and 34), Group III (Claim 33), Group IV (Claim 35) and Group V (Claim 36) with the elected Group I. This is not found persuasive because is related to process of making a product (Group I), process of using a product (Groups II and III) and the product (Groups IV and V).

In the instant case, the "making" process as claimed in Group I can be applied to make other and materially different type membrane other than using ion (cation or anion) exchange particles, as long as the particles is compatible with the polymer matrix. For instance, chelating compound is available. In a very close examination, each group is distinct from each other due to the existence of other functional group, in different order or in different sequence. Therefore the scope of the claims, i.e., the metes and boundaries are distinct.

2. The structural elements are mutually exclusive and the search terms are also mutually exclusive, thus they indeed create an undue burden on the Examiner. The requirement is still deemed proper and is therefore made FINAL.

Examiner now **accepts Applicants' seven drawing sheets with Figures 1-6** since a brief description has been found on page **11**. No **IDS** is filed so far**. Claims 1-38** with **five** independent claims (**Claims 1, 32, 33, 35 and 36**) are now pending**,** while non-elected Claims 32-36 (Groups II-V) are thereby withdrawn from consideration by the examiner. An action follows. (No international search report is found in Applicants' **WO 2004/005380 A1**)

Claim Objections

3. **Claim 1 is objected to** because of the following informalities:

On **Claim 1-(c)** at line 1, the language such as "dissolving said polymer with said matrix" may be improper. There are at least **four** different polymers shown up on lines 4, 6, 11 and 12. It is unclear which polymer is the said polymer. **Rewriting with clarification is needed**.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. The limitation of parent **Claim 1** relates to ***a process for producing ion exchange membranes***, *which comprises the* ***six*** *steps of:*

(a) ***Providing a matrix material, comprising a polymeric component*** *chosen from the group consisting of monomeric and oligomeric polymer precursors and cross-linkable polymers;*

(b) ***Introducing*** *in said matrix* ***ion cation or anion exchange particles, or proton or hydroxyl or ion conducting particles*** *or any combination of ion exchange, proton, hydroxide and ion conductivity,* ***or cation or anion exchange polymers, or proton or hydroxyl or ion conducting polymers*** *or any combination of ion exchange, proton, hydroxide and ion conductivity;*

(c) ***Mixing*** *said particles* ***or dissolving*** *said polymer with said matrix;*

(d) ***Forming*** *the resulting mixture* ***into membrane configuration****;*

(e) ***Ordering by an electric field*** *said particles or ordering by an electric field the domains of said polymer formed by polymer-matrix phase separation* ***upon solvent evaporation or cooling****; and*

(f) If said matrix comprises or consists of a polymer precursor or a cross-linkable polymer, said ***precursor is cured*** *concurrently with said ordering of said particles, or if the matrix comprises a polymer solution or polymer melt the said* ***polymer solution is evaporated*** *or the said polymer melt is maintained and then cooled concurrently with said ordering of said particles.*

See other limitations of dependent ***Claims 2-31 and 37-38****.*

6. **Claims 1-31 and 37-38 are rejected** under 35 U.S.C. 103(a) as being unpatentable over **Martin** et al. (US 5,718,947), **Aikman** et al. (US 5,746,954) and **Young** et al. (US 5,863,610), in combination or alone in view of **a combination of Roberts** et al. (US 6,114,031), **Takaoka** et al. (US 2006/0263660 A1) and **Morkved** et al. (Science, vol. 273, pp. 931-932, (1990)).

Regarding "the six-step (a)-(f) process of **preparing ion exchange membrane so as to achieve aligned nanostructure**" limitation of parent **Claim 1**, it is achieved by first mixing an ion-exchange polymer in a polymer matrix, then applying electric field, and finally crosslinking or drying so as to obtain the free standing membrane.

Three references including **Martin, Aikman and Young** in combination or alone has already disclosed the preparation of some membrane, coating or film by **depositing perfluoro-carbon type ion-exchange polymers on/within selected supported polymeric substrates**. The ion-exchange polymers can be also obtained by curing its respective precursor, while the whole process is achieved in the form of solution. The whole process fundamentally comprises the mixing, forming film or membrane, curing the precursor, and finally drying so as to obtain free standing form. See abstract and specification.

7. Therefore, **Martin, Aikman and Young** in combination or alone is "only" silent about **two** things including: **(A) applying the step of annealing as well as step of applying electric field for poling to aligned nonostructure, and (B) the motivation to do so. With respect to the silent (A), a combination of Roberts and Morkved** have taught such a subject matter. For instance, see **Roberts** at title; abstract; column 3, line 6-22 for poling the **ionomeric type** polymer by **applying electric filed** with a specific temperature controlling **above the glass transition temperature** and **cooling well below glass transition temperature**. See **Morkved** at page 931 at right middle section and middle bottom section for **adding the extra step of annealing above the glass transition temperature** in the course of applying electric field on polymers (see Figure 1). By doing so, an aligned nanostructure can be effectively obtained.

8. **With respect to the silent (B)** for the need and motivation to achieve such an aligned nanostructure, **Takaoka** alone has taught such a subject matter. **The increase of aligned nanostructure on proton-conducting membrane will effectively improve the reliability,**

efficiency and mechanical strength for fuel cell operation. See title; abstract; paragraphs 0033, 0074, 0080, 0089 and 0110.

9. In light of the fact that all involving references are dealing with making the same or similar polymer film or membrane as well as more aligned nanostructure is expected for fuel cell operation. Therefore, one having ordinary skill in the art would have found it obvious to modify **Martin, Aikman or Young**'s process of making **perfluorocarbon type ion-exchange polymers** film or membrane by **adding the extra step of annealing and then the extra step of applying electric field for poling to aligned nonostructure** as taught by a combination of three references including **Roberts, Morkved and Takaoka**. Therefore, better and more diversified fuel cell products may be obtained.

10. Regarding **Claims 2-10, 20, 28-29 and 37**, the polymer matrix or its respective precursor as well as the amount and its mixing sequence are disclosed or at least suggested by above-mentioned references and the references cited therein. For instance, see **Martin** at column 5, line 62 – column 6, line 13 for polymer matrix.

Regarding **Claims 11-19**, the form, the shape and the like of ion exchange particles are disclosed or at least suggested by above-mentioned references and the references cited therein.

Claims 21-27 relate to the condition of applying electric field, **Claims 30-31** relate to the configuration of the ion-exchange membrane, while **Claim 38** relates to the application of such

obtained membrane in the specific area of fuel cell. All limitations are disclosed or at least suggested by above-mentioned references and the references cited therein.

Conclusion

11. The prior art made of record and not relied upon is considered pertinent to applicants' disclosure. The following references relate to a process for producing ion exchange membranes, which comprises six steps as specified:

US 5,082,472 to Mallouk et al., US 4,433,082 to Grot, and US 4,940,525 to Ezzell et al. each only discloses the preparation of some perfluorinated ionomer type "membranes and/or composite membrane". Said perfluorinated ionomer comprises **two** types monomers including: (A) **48-85 mol%** of **tetrafluoroethylene** (TFE), and (B) **15-47 mol%** of sulphonyl fluoride-containing monomer such as **CF_2=CF-O-CF_2-CF_2-SO_2-F or the like**. The claimed six-step (a)-(f) process of **preparing ion exchange membrane by applying electric field so as to achieve aligned nanostructure**" is not disclosed or suggested.

12. Any inquiry concerning this communication or earlier communication from the examiner should be directed to **Dr. Henry S. Hu whose telephone number is (571) 272-1103**. The examiner can be reached on Monday through Friday from 9:00 AM –5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dr. Vasu Jagannathan, can be reached on (571) 272-1119. The **fax** number for the

organization where this application or proceeding is assigned is **(571) 273-8300** for all regular communications.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Peter D. Mulcahy/
Primary Examiner, Art Unit 1796

/Henry S. Hu/
Examiner, Art Unit 1796

June 20, 2009